

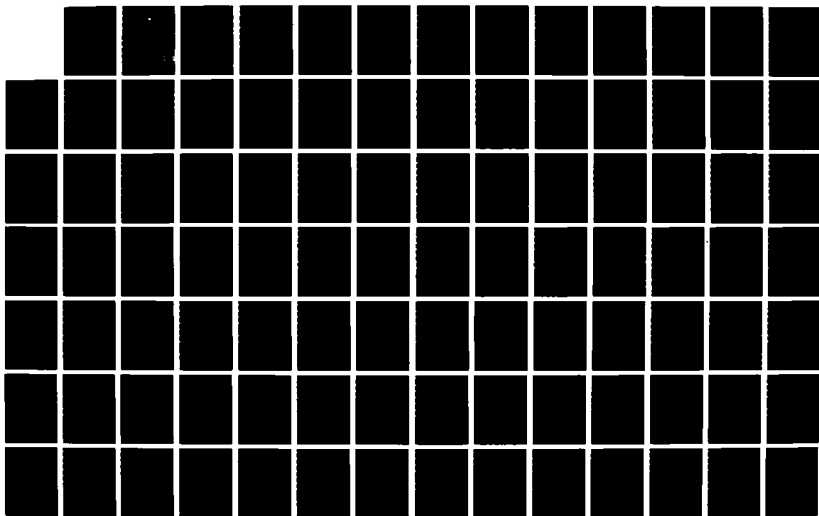
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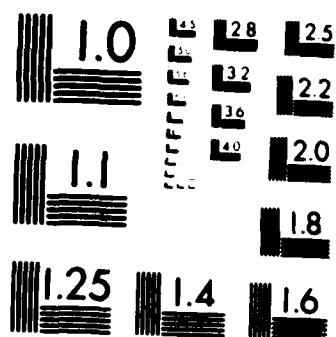
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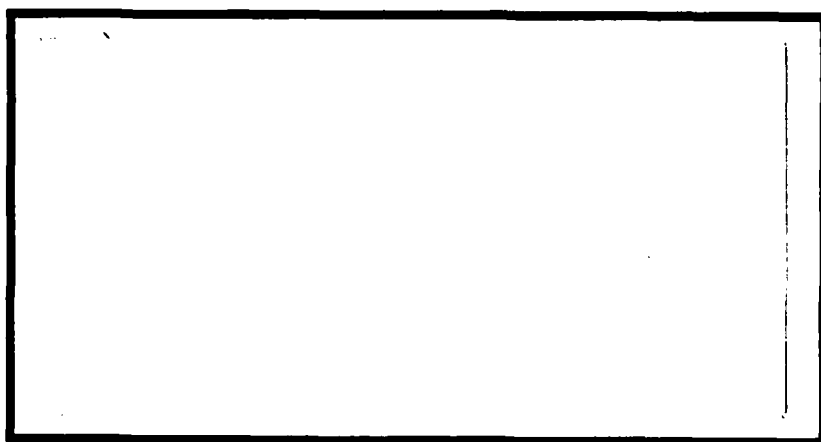




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THE COMMUNICATION OF THE USER'S
REQUIREMENTS TO THE SYSTEM PROGRAM
OFFICE DURING THE ONGOING
SYSTEM DEVELOPMENT PROCESS

THESIS

Russell B. Smariga
Captain, USAF

AFIT/GSM/LSY/87S-31



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AFIT/GSM/LSY/87S-31

THE COMMUNICATION OF THE USER'S REQUIREMENTS
TO THE SYSTEM PROGRAM OFFICE DURING THE ONGOING
SYSTEM DEVELOPMENT PROCESS

THESIS

Presented to the Faculty of the School of Systems and
Logistics of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Systems Management

Russell B. Smariga, B.A.
Captain, USAF

September 1987

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Preface

The purpose of this study was to provide those Air Force officials concerned with the research and development/ systems acquisition process with information about the communication of systems requirements from the end-user to the system program office. The immediate objective of this research is to identify the factors which are related to the successful communication of requirements, but it may be applicable to other areas of the acquisition process as well.

In performing this research and writing this thesis I had a great deal of help from others. I am deeply indebted to my thesis advisor, Major William R. Hitzleberger, for his continuing support and effort to keep the focus of this project on the process and results. I also wish to thank my wife Captain Linda Smariga, also a graduate student at AFIT, for her unending support and patience over the sixteen months we spent completing this program, together.

Russell B. Smariga

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Abstract

Air Force acquisition program management officers (n=292) were surveyed to determine which factors in the user to system program office requirements communication process were related to achieving effective communication. Using command representatives (n=17) working at Aeronautical Systems Division were also contacted to provide their perspective of the communications process. Results obtained from reading the comments on the questionnaires and from the interviews indicated that both program managers and user representatives believed that additional operational experience on the part of acquisition management personnel would enhance the requirements communication process. The analysis of the data, however, did not support this. Operational experience of the program manager was not statistically related to any of the measures of successful communications.

Program managers who had completed AFIT Systems 100 tended to have a more positive outlook on both the desirability of having a user representative in the SPO, and of the overall requirements communication process. This relationship was not present for any other single acquisition management-related course.

The results indicate that no single factor contributes significantly to the success or failure of the systems requirements communication process.

THE COMMUNICATION OF THE USER'S REQUIREMENTS
TO THE SYSTEM PROGRAM OFFICE DURING THE ONGOING
SYSTEM DEVELOPMENT PROCESS

I. Introduction

Background

The purpose of the Air Force weapon system acquisition process is to develop, produce and deliver to the field a logistically supportable end-product which not only works, but also meets the specific validated need, or alleviates the particular deficiency which prompted the initial development. The weapon system acquisition process is influenced by many factors such as funding availability, funding stability, cost stability, schedule constraints, and stability of program requirements. One of the most important influences on the success of a program is the stability of the requirements which are placed on the program, both in terms of quantity required and specific performance requirements. Successfully defining specific performance requirements implies active communication between the System Program Office (SPO) and the user of the system. One of the most difficult tasks which the program manager is charged with in today's defense system acquisition environment is the successful interpretation, as seen from the user's

viewpoint, of the initial set of requirements. Just as important as initial requirements interpretation is the ongoing system development process during which the program manager must ensure that the user's requirements are being properly implemented. A key part of this validation process is the frequent participation by the user in the development process. "How are the user's detailed performance requirements addressed throughout the on-going system development process?" is an important question to be addressed if the acquisition process is to be as efficient as possible.

Statement of Problem

In answering the general question posed above, the specific problem addressed in this study is the identification of the factors which contribute to the successful communication of the user's requirements to the SPO, and to the implementation of those requirements into the ongoing system development process.

Investigative Questions

In addressing this specific problem, the following questions were considered.

1. How are most of the communications between the SPO and user conducted, e.g., by message, phone, etc.?
2. How frequently do the SPO and user communicate?
3. Do most communications follow formal or informal command channels?

4. Does SPO and/or user acquisition experience contribute to better communication?

5. Does having operational experience (or the lack of it) effect the program manager's ability to effectively interpret and implement requirements?

6. Does physical separation of the SPO and the user's main operating location interfere with communications?

7. Do travel constraints such as limited TDY funding interfere with communications?

Scope

This research studied the population of program and project managers at all major Air Force Systems Command (AFSC) product divisions. Data collected included information on the current state of communications between the SPO and the end user of the system in the field, techniques used in this process, and the overall effectiveness of the process. The study also collected information from a small number of user representatives serving at Aeronautical Systems Division (ASD).

Limitations

This study drew the largest portion of data from active duty Air Force officers, O-2 through O-5, who either currently work in a 27XX position, or have in the immediate past worked in a 27XX position. The population was further limited in that only data from individuals who had at least six months experience in a 27XX position were considered,

and only those managers who were stationed within the continental United States were considered.

Representatives of the operational using commands, including Military Airlift Command (MAC), Strategic Air Command (SAC), and Tactical Air Command (TAC), currently serving in liaison positions at ASD provided information on how the user views the current requirements communication process.

The study does not include any perceptions of those officers who are serving as program managers with 28XX AFSC's at Electronic Systems Division (ESD), but does include information from 27XX program/project managers at ESD.

Specifically excluded from this study was the initial definition of requirements for the development process. Initial definition of requirements includes the initial statement of a need by the user, the development of the Statement of Operational Need (SON) and the complete requirements validation process. This study only addressed the communication process between the user and the SPO subsequent to the issuance of a program management directive from HQ USAF to HQ AFSC.

The conclusions drawn from this study are based on self-reported data provided by individual Air Force officers connected with the research and development systems acquisition process.

Assumptions

It is assumed that the personnel involved in the acquisition process to be randomly selected for this study have a basic understanding of the communication channels and techniques available to them within the limits of Air Force regulations and individual program constraints such as funding limitations or special security restrictions. Since all of the program/project managers in this study are officers, and have at least six months experience as program/project managers, this assumption should be valid. This should also be a valid assumption for all of the user representatives who participated.

Definitions

Acquisition Program. A defined effort funded by research, development, test and evaluation (RDT&E) and/or procurement appropriations with the express objective of providing a new or improved capability in response to a stated mission need or deficiency.

Program Element Monitor. The person within the HQ USAF office of primary responsibility who is directly responsible for a given program and all documentation necessary to harmonize the program in the budget.

Program Management Directive. The official HQ USAF management directive used to provide direction to the implementing and participating commands and satisfy documentation requirements. It will be used during the

entire acquisition cycle to state requirements and request studies, as well as initiate, approve, change, transition, modify or terminate programs.

Program Manager. The individual in the DoD chartered to execute all functions necessary for the development and purchase of a defense system.

Project Manager. A project manager is usually responsible for a sub-component of a larger system and reports directly to a program manager.

Statement of Operational Need. A formal numbered document used to identify an operational deficiency and state the need for a new or improved capability for US Air Force forces.

SPO Director. A SPO director is the overall chief of a System Program Office. If the SPO is a single system SPO then the SPO director is probably also considered the program manager.

System Acquisition Process. The system acquisition process is defined as a sequence of events, beginning with the determination that an unfulfilled mission need exists, and extending through research, development and production of a system, to the operational use of that system.

System Program Office. The office of the program manager and the point of contact with industry, Government agencies and other activities participating in the system acquisition process.

User. The user is defined as the operational command, or any of its subordinate units or personnel, to which the developed system will be delivered for use.

II. Literature Review

Introduction

This literature review is the foundation for the study of the on-going communication of system requirements from the user to the SPO and the continued refinement of requirements throughout the system acquisition process. The purpose of this review is not to provide a review of all the communication methods available. Instead, the purpose is to review literature which addresses factors such as cost stability, personnel quality, defense contractor involvement, and outside agency involvement to provide a view of the complex framework in which SPO/user communications take place.

The requirements development process can be facilitated by involving people who are knowledgeable in the applicable mission area for the system. Frequently, the most knowledgeable people are those who will be working with the system once it is fielded, i. e., the users. However, since the users, in most cases, are not located with the SPO's, communication between the two is difficult and development of the statement of mission requirements is hindered.

Discussion of the Literature

The information available on user interaction during the development process comes almost exclusively from civilian literature because civilian business organizations must rely

heavily on successfully defining and satisfying customer (user) requirements.

The environment in which Department of Defense acquisition programs must be managed is an extremely complex one where many influences, both internal and external to the program, contribute to program stability and to the overall success or failure of the program. Of particular importance in establishing program stability are funding and cost stability, personnel quality, defense contractor involvement, and user involvement in the development and continued refinement of system requirements.

Funding and Cost Stability. The high attention level that money and money-related topics command in the public eye forces all personnel involved in program management to pay particular attention to the cost figures associated with their programs. According to Jacques S. Gansler achieving success in money related areas in program management is dependent on at least two things: congressional funding stability; and accuracy of initial cost estimates (6:3,7).

Funding. Stability of congressional funding levels is important because when Congress projects that a certain amount of money will be available for a certain program, that program's acquisition strategy is shaped accordingly. Gansler says that the acquisition strategy on most programs contains back-up plans in case funding levels are reduced, but the implementation of these back-up plans usually results in greater overall program costs (6:4).

When Congress does reduce funding levels, even if only for a short period of time, programs are stretched over a longer period. This alternative is usually chosen instead of lower-priority programs being canceled. This results in higher overall program costs and "because the quantities of equipment being produced in any one year are smaller, their unit costs rise" (6:4). Stanley Baumgartner agrees "stability in funding is also essential" (2:32).

Cost. In Baumgartner's, one of the key measures of the success of any DoD program is whether or not it "meets cost objectives" (2:32). One condition necessary to meet cost objectives is to have the stability in funding levels described above. A second necessary condition is to have an honest, realistic initial cost estimate (6:7). If the initial cost estimate, against which the program will be judged, is too optimistic, the chances of meeting the cost goals are very low. Many programs are initially estimated low to help ensure that they will be approved, but then end up costing much more due to "inefficiencies caused by program instability and stretchout" (6:7).

General Mullins expands the idea of cost to include the entire life cycle of a program (7). He suggests that by allocating a small portion of the money for production units of a system to support-related items, the U. S. could have a significantly enhanced fighting force, which is "combat-ready" (7:4).

Personnel Quality. If inanimate influences such as funding and cost have such a great impact on program success, it follows that the people involved should have an even greater impact. In a survey of managers of successful programs, three staff members at the Defense Systems Management College (DSMC), including Stanley Baumgartner, found that one of the most frequently cited contributors to program success was the quality of personnel (2:32). LtCol William Smith states that "programs are run by people, and the better people [the program manager] can attract, the better the program will be managed" (12:25). LtCol Smith also suggests that success breeds success when he states that "the most successful program manager attracted good people, provided the guidelines . . . and let them act" (12:25). Boar agrees that quality people "contribute to the success" (3:31) of a project.

According to R. A. Robinson, not only must personnel involved with a program be of good quality for the program to be successful, they must have a good leader to imitate (11:27). Employees must all know the goals of the program, and know that "success of the total program [means] personal success" (12:25). Mr. Robinson carries this to the extreme when he says that in a successful operation "all employees are operating according to the same set of beliefs, in much the same way followers of a particular religious faith adhere to the same beliefs" (11:26).

Defense Contractor Involvement. Quality of personnel is as important on the civilian contractor's program team as it is on the government's side. Stanley Baumgartner states that, "with few exceptions all [program managers of successful programs] characterized their contractors as being very good or excellent" (2:35). An important ingredient in program success is "openness and frankness on the part of the [program manager] and his industry counterpart" (2:35). To lead to success, Boar says this openness must provide the development contractor with a full understanding of "user needs" (3:25).

One interesting point concerning contractor involvement in the system development process is brought out by General Mullins.

Under the current arrangement, then, the contractor validates the results of his independent research through marketing briefings to the using commands; when such briefings lead to a contract award, the contractor has, in effect, created a requirement. In reality, weapons capabilities influence military requirements, and prime contractors develop weapons capabilities (7:4).

General Mullins implies that contractors do not always have the best interests of DoD in mind, and that DoD must work harder to influence contractors in early stages of their involvement with any program or concept (7:4-6).

User Involvement in Requirements Definition. The ideal combination of stable funding levels, stable program costs, high quality DoD personnel and dedicated contractor personnel will not lead to success if the requirements of

the user are not both clearly stated and clearly understood by all involved. This communication of the user's requirements to the developer is the common theme which links together all of the literature in this review. LtCol Smith states, "the user connection is all important" (12:25). Boar adds that

The solution to the communication problem was never to make everyone a professional specifier, but to permit everyone to review specifications in a familiar medium (3:31).

Boar suggests that this "familiar medium" (3:31) should be a prototype of the working system, which would allow user to evaluate the system hands-on and provide meaningful feedback (3:25,27,29). Gansler says that it is important for the user to be as close as possible to the developer, and that user requirements be established early and adhered to throughout the program (6:8,10). "Typically, a successful program's requirements have been established early . . . and requirements stay virtually intact throughout a particular phase of a program" (2:37). It is informative to review civilian literature related to satisfying the customer, because the only way product-oriented businesses satisfy customers is by providing products (systems) which are responsive to users' needs. Speaking from the civilian sector, Mr. Robinson shows that industry considers user needs important also by stating, "with each employee acting on the wants of the customer . . . [a] company will make more productive use of resources" (11:27).

Furthering this idea is William G. Ouchi who states that a key objective of the organization is "To serve as the customers' purchasing agent in fulfilling their needs and expectations for merchandise and services" (8:137-138). David Packard says that a key objective must be "To provide products and services of the greatest possible value to our customers" (8:227). A further Hewlett-Packard objective is that "Good communication should be maintained with the customer" (8:228). Tom Peters makes the point that it is important to involve the customer at every step by asking the questions "Does the customer know how hard you are working for him/her (via what mechanisms, how assiduously practiced)?" (10:89), and "Do you have any 'simple' rituals, like . . . weekly calls to ask 'How are we doing for you?' "(10:105). Peters quotes one unidentified successful company president as saying "' . . . you've gotta be in touch. You've gotta press the flesh. You've gotta show the flag. Somehow. . . . But being out of touch is bad news'" (10:106). Peters states that a key to success in a company or on a project is to make sure that "Visits with customers are exchanged regularly, at all levels in the company and customer organization" (10:125). He says that these "Visits to customers and time spent with them should never run less than 30 percent for senior line management, and not less than 10 percent for indirect function management" (10:127). Another way of conveying Tom Peters' view of the importance

of customer involvement is his idea of how a poorly managed operation is run.

People stored away in little cubbyholes, hundreds of miles from the scene, follow a precise manual and escalate their response according to the manual's definition of the customer's need. The only problem is, they never tell that customer just how hard they're working for him or ask him if the response meets his definition of the need (10:85).

Tying these concepts back to the DoD acquisition management system, LtCol Ronald J. Penick states that

If these organizations [users and other related agencies] are involved in development of the initial [program] plan they become committed to the program and will support it with considerably more enthusiasm than they will if asked to join the team later (1:191).

Speaking from the user's viewpoint, General Sir Martin Farndale, a NATO commander, delineates operational tactics for the European theater, and devotes almost as much space to stating equipment and personnel requirements as he does to the actual description of tactics (5). General Farndale goes a step further in the requirements definition process by giving additional information, in the statement below, which aids in setting the relative priority of the requirements he stated previously in the article.

Although I have listed several improvements to equipment which are needed, both now and in the future, this is not to say that the operation cannot be carried out now. It can, but the equipment I mention is needed to enhance our offensive capability so that we can carry it out more effectively. It is also necessary to enable us to keep up with the developing threat (5:9).

On the other hand, also writing as a user, General Mullins conveys, in the following quotation, that the process is not

yet perfect, and is sometimes hindered by the users themselves.

Nor have we always done a good job of articulating the requirement, often hitting the system program managers with "second-thought" or "after-the-fact" needs (7:5).

Gansler shows that this difficulty in firmly establishing requirements often leads to program instability (6).

Finally, the President's Blue Ribbon Commission on Defense Management reinforces the overall idea that the appropriate system acquisition model to pattern the DoD after is that which results from studying "successful programs from private industry" (9:11). One of the underlying features of the successful programs to be emulated is solid communication with the user. The report to the President presents the following.

Communication with users. A commercial program manager establishes a dialogue with the customer, or user, at the conception of the program when the initial trade-offs are made, and maintains that communication throughout the program. Generally, when developmental problems arise, performance trade-offs are made - with the user's concurrence - in order to protect cost and schedule. As a result, a program manager is motivated to seek out and address problems, rather than hide them (9:50).

The report carries this idea of closeness to the customer throughout its analysis of the acquisition process. In a statement about a proposal to create a separate, single Defense Acquisition Corps the report states that

Because [the proposal] would have the undesirable result of putting too much distance between acquisition programs and users, . . . we do not support the proposal in its full form (9:67).

Conclusion

System acquisition program stability, both in the Department of Defense and in the civilian sector, is dependent on several factors. Stable funding levels must be set and maintained by Congress. Along with stable funding levels, program costs must be maintained within established limits. The quality of government and contractor personnel associated with a program is at least as important to program stability as funding and cost.

Even if all of the above factors are in place, a program will not remain stable and be successful unless a clear definition of what the user wants is understood by all parties involved in the acquisition process. One basic conclusion which can be drawn from the literature is that to develop and maintain this clear understanding of requirements, the user must be actively involved in the system development process. Keeping the user involved requires that program office and contractor personnel, as well as the user, be willing to maintain open, active communications, so that the best possible system is delivered to the field.

III. Methodology

Introduction

This chapter outlines the methodological approach to the research problem. It presents the justification for survey, and describes the survey instrument, pilot study, population, assumptions, and analytical method.

Synopsis. The methodology used to solve the stated research problem began with a thorough review of applicable literature. A survey instrument was then developed. The draft survey was administered to two AFIT Systems 400 classes to form the basis for a pilot study, which helped refine and clarify the instrument. The final survey instrument was distributed to a randomly selected sample taken from the population of Air Force program/project managers (AFSC 27XX), First Lieutenant through Lieutenant Colonel. Sample size was determined using the HQ USAF/ACM guide for developing surveys, and numbers of officers currently serving with duty AFSC's of 27XX, provided by the ATLAS Database. Once the data were collected they were statistically analyzed via several methods. A convenience sample of representatives from using commands (MAC, SAC, TAC) was taken from personnel currently assigned to the using command Systems Offices at ASD. These personnel provided their views on a limited set of issues related to the requirements communication process. Finally, results of the study were

presented and recommendations were made for further research.

Justification for Survey

A survey, distributed by mail, was chosen as the best way to collect the data required within the time constraints of this research project. An alternate method for collecting the data would have been to conduct personal interviews, but due to the time-consuming nature of this process the sample size which would have resulted would have been too limited to provide any generally applicable insights. A limited number of personal interviews were conducted with user representatives so that their perspective could be presented. Due to the dispersed nature of user representatives working as program liaisons in the field, a large-scale survey of these personnel was not practical.

Instrument/Pilot Study

The survey instrument was designed to collect both standard demographic data, program related data, and data describing frequency of communications between the SPO and user, method of communication, number of requirements changes which have been implemented on the program, and other program related data. Demographic data collected include:

- Rank
- Academic Degree(s) held
- Major Academic Field of Study
- Years of Service
- Years of Program Management Experience

Professional Military Education
Professional Program Management Training
Current Product Division
Current Position (SPO Director,
Program Manager, Project Manager)
Number of People Directly Supervised
Role in Decision Process

Program related data collected include:

Dollar Value of Current Program
Current Phase of Program
Type of SPO which Program is a part of
(Single System SPO, Basket SPO)
User Location (ConUS, OConUS, etc.)
Presence/Absence of User Representative
in SPO

SPO/user communication data collected include:

Frequency of Communication
Frequency of SPO-initiated Communication
Frequency of User-initiated Communication
Frequency of Face-to-face Meetings
Frequency of User Expressing Dissatisfaction
Method of Day-to-day Communication
Method of Communicating Requirements
Formal/Informal Communication Channels
Number Initiated by SPO of:
 Informal Requirement Changes
 Formal Requirement Changes
Number Initiated by User of:
 Informal Requirement Changes
 Formal Requirement Changes
Percentage of Time Higher Headquarters
are Involved in Communications

On the survey instrument itself, the overall order of
presentation of questions was:

Programmatic Data
Communications Data
Demographic Data

The demographic data was presented last so that the
respondent was as fresh as possible when answering the
programmatic and communications related questions. Questions
within the communications section were arranged so as to

maximize internal validity, for the instrument. Questions related to how often an activity occurs asked respondents to reply on a five point Likert-type scale, as in the following sample question from the survey.

How often does the user initiate communication with you?

- A. Never
- B. Rarely
- C. Sometimes
- D. Almost Always
- E. Always

All questions, except those pertaining to demographic data, were answered using five point scales similar to that above. All questions included were designed to provide information on which factors in the SPO/User communication process are related to the successful implementation of program requirements.

In draft form the survey instrument was administered to a group of relatively experienced program/project managers. These managers were students in an AFIT Systems 400 course, which is designed to provide exposure to advanced topics in acquisition management to staff level program managers. The survey was tested in this environment to help ensure that questions were not ambiguous, and that no significant variables were left out.

As a result of the feedback received from the pilot study, the survey was changed in several ways. The original survey instrument for the pilot study used a percentage-

based scale for responses concerning event frequencies. Many comments from participants showed that this scale was difficult to interpret. This led to changing the response scale to the one described above. Many participants also expressed confusion as to the precise definition of user, requirement change, and contract change. As a result, definitions of these terms were included in the instructions accompanying the survey. The question in the pilot survey concerning the current phase of the program did not include a response category for a post-production or modification phase. Several respondents indicated that such a category was needed, so it was added.

The pilot study was delivered to 50 people, and 35 responded, yielding a response rate of 70 percent. Of those responding, 61 percent were majors and 39 percent were lieutenant colonels. Since the sample size was small, and since only a narrow section of relatively experienced personnel participated, the pilot study was used only to clarify and improve the survey instrument. No meaningful, externally valid analysis could be performed with the limited responses available.

Population/Assumptions

The population of interest is all acquisition management personnel, with a duty Air Force Specialty Code (AFSC) of 27XX, who are active duty officers, grades O2 through O5, and are currently stationed within the continental United States

(CONUS). The ATLAS Database indicated that there were 1524 officers with fully qualified 27XX AFSC's. These could be divided into two groups of interest. 878 officers with a 2724 AFSC, and 646 officers with a 2716 AFSC.

Sample Selection/Size. Based on the information from the ATLAS Database, and the fact that it is desirable to use a stratified random sample to ensure that the data collected represents the full range of acquisition management experience, the following method was used. The desired sample sizes were calculated using the HQ USAF/ACM sample size formula (4:11-14).

$$n = \frac{N(z^2) * p(1-p)}{[(N-1) * (d^2)] + [(z^2) * p(1-p)]}$$

where: n = sample size
N = population size
p = maximum sample size factor (.5)
d = desired tolerance (.05)
z = factor of assurance for 95% confidence level (1.96)

This formula can be used when the population sizes are known, and a confidence/reliability level of 95% ± 5% is desired. After the initial sample sizes, 267 for 2724 and 241 for 2716, were obtained from the above equation, they were multiplied by 1.43, in anticipation of a 70% survey return rate. For the strata, sample sizes of 381 (2724) and 344 (2716) resulted.

Using these numbers, a request for a listing of 725 names, to be randomly selected from within the strata, was

submitted to the ATLAS Database. A list of 724 names resulted, and 724 surveys were mailed.

A convenience sample of 17 personnel working with the using command Systems Offices at ASD were contacted to participate in an interview questionnaire.

Analysis

The key dependent (response) variable analyzed was the effective communication of the users' system requirements to the SPO. This was operationally defined in terms of the frequency of the users voicing dissatisfaction to the SPO about problems with system requirements implementation, as reported by acquisition management personnel working in SPO's. The statistical analysis technique which is most suited to evaluating relationships between the response variable and the other variables is discriminant categorical data analysis. This is true since the level of data will be primarily nominal and ordinal. Descriptive statistics concerning the data were also calculated.

Computation Method. The SAS statistical analysis package running on a Digital Equipment Corporation VAX 11/780 computer system at AFIT (the Classroom Support Computer) was used to perform all calculations. Two procedures within the SAS package were used: Proc Means, and Proc Freq. Proc means was used to calculate all descriptive statistics. Proc Freq was used to generate the two-way contingency tables used in the categorical data

analysis. Proc Freq also calculated chi-square values where appropriate, to help identify any relationships between the response variable and other variables. The chi-square independence test for this categorical analysis of the response variable and appropriate selected variables was conducted with the null hypothesis that there is no relationship, represented by:

$$H_0: p_{ij} = p_i * p_j \quad \text{where: } p_{ij} \text{ is the probability of a} \\ \text{a randomly selected indi-} \\ \text{vidual being in both a par-} \\ \text{ticular row and column of} \\ \text{the contingency.}$$

And the alternate hypothesis is that there is a relationship between the response variable and the other selected variables:

$$H_a: H_0 \text{ is not true.}$$

These tests will be conducted at the .05 significance level.

From a practical standpoint, the results of these statistical tests should provide some insight into which factors in the requirements communication process are the most important. Based on this analysis some recommendations for further research were made.

IV. Results and Discussion

Introduction

This chapter presents the demographic data collected, and the results of the statistical analyses performed, along with other results deemed suitable for presentation and review. The demographic data are presented first, and then the results are presented for each investigative question, beginning with Question 1. Other pertinent findings are presented last.

General Information

This section provides general information about the data collection and response level, and gives summaries of pertinent demographic data.

Data Collection. Of the 724 surveys that were sent out, 385 were returned for an overall response rate of 53 percent. 93 of the 385 respondents indicated, on survey question 1, that they were not in system acquisition, leaving 292 responses usable for the analysis conducted. This resulted in a usable response rate of 40 percent. The number of surveys available for analysis resulted in an actual confidence interval somewhat less than the 95 ± 5 percent, as presented in Chapter III. However, since the surveys which were returned, but not used, were from 27XX's not currently working in areas directly related to system acquisition, the population of interest, presented in Chapter III., can be reduced in size. It is also reasonable

to assume that of the 47 percent who did not respond there were some number who also were not currently involved in areas directly related to systems acquisition. This would further reduce the baseline population of interest. Therefore, based on 292 usable responses and the above discussion, the results are presented with an approximate confidence interval of 90 ± 5 percent.

Demographics. The data collected are shown by the tables below to be representative of a wide cross section of the 27XX career field. The data shown below were collected as responses to survey questions 40, 1-3, 6, 8, 41-44, 46-47, 49, and 50, respectively.

Table 1
Product Division Involved

PRODDIV	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
ASD	141	49.0	141	49.0
ESD	29	10.1	170	59.0
SD	31	10.8	201	69.8
AD	21	7.3	222	77.1
HSD	5	1.7	227	78.8
BMO	17	5.9	244	84.7
Other	44	15.3	288	100.0

Table 1 shows that, as expected, the largest percentage of respondents (49 percent) were members of ASD, but every product division was represented. The majority of those personnel responding in the "Other" category were currently

working on a joint service program or as a program manager for a test facility. Respondents were approximately evenly split between single system SPO's and basket, or multi-program, SPO's, with 118 working in single system SPO's, and 132 in basket SPO's.

Table 2
Type of SPO or Job

SPOTYP	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Single Sys SPO	118	40.5	118	40.5
Basket SPO	132	45.4	250	85.9
Work as SYSTO	21	7.2	271	93.1
Work as PEM	20	6.9	291	100.0

Table 3
Phase of Program

PHASE	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Concept Exp Phase	7	2.4	7	2.4
Dem/Val Phase	28	9.7	35	12.2
FSD Phase	74	25.7	109	37.8
Production Phase	55	19.1	164	56.9
Post Prod/Mod	10	3.5	174	60.4
Concept/Dem/Val	15	5.2	189	65.6
Dem/Val/FSD/Prod	38	13.2	227	78.8
Prod/Post Prod	19	6.6	246	85.4
Early & Late Phas	42	14.6	288	100.0

The good distribution of respondents between single system and basket SPO's, shown in Table 2, allowed a comparison to be made between the two environments to determine if any possible difference existed in communication techniques or their perceived successfulness. This comparison will be presented in a later section.

The respondents were involved in programs which represented the entire range of the systems acquisition process, as shown in Table 3. The largest group of respondents (44.8 percent) were involved with either full-scale development or production programs. More than expected (39.6 percent) were involved either in several programs, each of which was in a different phase, or in a single program of concurrent nature, that is, a program which is compressed so that it is in two or more phases simultaneously (see Table 3).

Table 4
Total Program Cost

COST	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Less than \$100K	1	0.3	1	0.3
100K - 999K	7	2.4	8	2.8
1M - 29.9M	44	15.2	52	18.0
30M - 99.9M	43	14.9	95	32.9
100M or more	194	67.1	289	100.0

Table 4 shows that the majority (67 percent) of programs which respondents are working involve more than \$100 million. Fully 82 percent of the programs involve greater than \$30M.

Table 5 shows that the largest (26.4 percent) group of respondents work programs which will support users from more than one command. Those respondents reporting "Some Other User" usually stated that their users were DoD or national agencies, or were classified. The 50 respondents not answering this question reported that they support overseas users.

As expected, Table 6, shows that the majority of users are field units, with only 22 percent representing headquarters.

Table 5
Command of the User

USERCMD	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
User is SAC	56	23.1	56	23.1
User is TAC	62	25.6	118	48.8
User is MAC	14	5.8	132	54.5
User is ESC	3	1.2	135	55.8
User is ATC	3	1.2	138	57.0
User is AFCC	1	0.4	139	57.4
User is AFLC	2	0.8	141	58.3
User is AFSC	11	4.5	152	62.8
Some Other User	26	10.7	178	73.6
Mutiple Users	64	26.4	242	100.0

Table 6
Field or Headquarters User

USERTYP	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
User is HQ	62	22.2	62	22.2
Field Unit	168	60.2	230	82.4
Other	34	12.2	264	94.6
HQ and Field	15	5.4	279	100.0

The rank of the respondents was fairly evenly spread (see Table 7). This is as was expected, since the sample was drawn from 2724's, O-2 through O-4, and 2716's, O-4 and O-5. It is not known how the survey reached the second lieutenants who responded, but the colonels wrote comments to the effect that they were either recently promoted or had a line number to colonel.

Table 7
Rank of Respondent

RANK	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
2LT	3	1.0	3	1.0
1LT	82	28.4	85	29.4
CAPT	77	26.6	162	56.1
MAJ	54	18.7	216	74.7
LTCOL	71	24.6	287	99.3
COL	2	0.7	289	100.0

Table 8
Type of Degree held

DEGREE	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Bachelor's	125	43.1	125	43.1
Master's	163	56.2	288	99.3
Doctoral	2	0.7	290	100.0

There was an approximately even split between those respondents who had bachelor's degrees and those who had Master's degrees (see Table 8).

Approximately 70 percent of the respondents had at least one degree which was in an engineering or technical field. Table 9 shows that only 19.6 percent of those responding had a non-technical degree. 34.7 percent responded that they had degrees in more than one discipline, with the most frequent combination being a technical undergraduate degree and a graduate degree in a management-related field.

Table 9
Area of Specialization

DEGTYP	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Engineering	93	32.0	93	32.0
Sci/Math	28	9.6	121	41.6
Non-Tech	57	19.6	178	61.2
Other	12	4.1	190	65.3
Multiple	101	34.7	291	100.0

Table 10
Type of Position by Title

TITLE	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
SPO Director	3	1.0	3	1.0
Pgm Mgr	68	23.4	71	24.5
Prj Mgr	74	25.5	145	50.0
SYSTO	18	6.2	163	56.2
PEM	18	6.2	181	62.4
Dep SPO Dir	3	1.0	184	63.4
Mgr Of Prj Mgrs	31	10.7	215	74.1
Config/Data Mgr	2	0.7	217	74.8
Proj Engr	4	1.4	221	76.2
Test Mgr	22	7.6	243	83.8
Other	47	16.2	290	100.0

Table 10 shows that 61.3 percent of the respondents are directly involved in program management either as program managers, or as SPO directors. The majority of those responding in the "Other" category stated that they were involved in the cost/financial management area. Those who were not directly involved in program management, but did respond to the survey, indicated that they did communicate with the users concerning requirements, and, therefore, they were included in the analysis.

The majority (60.2 percent) of those responding had less than four years experience in program management (see Table 11).

62.2 percent of respondents have had no operational experience during their careers. Table 12 shows that 37.8 percent have had at least one operational tour. 14.8

Table 11
Years Experience in Program Management

EXP	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
1/2 - 1 yr.	26	9.5	26	9.5
1 - 2	67	24.5	93	33.9
3 - 4	72	26.3	165	60.2
5 - 10	84	30.7	249	90.9
> 10	25	9.1	274	100.0

percent of those stating that they had operational experience said that they were rated. The remaining operational experience was in missile operations, maintenance, space operations and other operational assignments.

Professional military educational (PME) levels ranged from none (11 percent, Table 13) to all (3.1 percent, or nine respondents). "All" PME included SOS, ACSC, AWC, and ICAF. The most frequently mentioned "other" PME course which was mentioned was Marine Command and Staff College.

Table 12
Summary of Operational Exp

EXPSUM	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
OPER	110	37.8	110	37.8
NON-OPS	181	62.2	291	100.0

Table 13

PME Summary

PME	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
SOS ONLY	119	40.9	119	40.9
ACSC ONLY	3	1.0	122	41.9
AWC ONLY	1	0.3	123	42.3
SOS & ACSC	66	22.7	189	64.9
SOS & AWC	1	0.3	190	65.3
SOS & ICAF	4	1.4	194	66.7
SOS, ACSC, AWC	28	9.6	222	76.3
ALL	9	3.1	231	79.4
OTHER	28	9.6	259	89.0
NONE	32	11.0	291	100.0

Table 14

Acquisition Educ Summary

SCHOOL	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
SYS100 ONLY	19	6.5	19	6.5
SYS200 ONLY	11	3.8	30	10.3
SYS400 ONLY	11	3.8	41	14.0
DSMC ONLY	41	14.0	82	28.1
SYS100 & SYS200	95	32.5	177	60.6
ALL SYS	20	6.8	197	67.5
SYS & SAS	1	0.3	198	67.8
SYS & DSMC	4	1.4	202	69.2
SAS & DSMC	1	0.3	203	69.5
NONE	22	7.5	225	77.1
SAS ONLY	11	3.8	236	80.8
MULTI	56	19.2	292	100.0

Professional continuing education related to acquisition management also ranged from none (7.5 percent, Table 14) to AFIT Systems 100, 200, and 400 (6.8 percent) to some AFIT

courses and DSMC (1.4 percent). As expected, the largest respondent group stated that they had completed AFIT Systems 100 and 200, or equivalent courses such as the introductory course at Systems Acquisition School (SAS), at Brooks AFB.

Investigative Question Results

This section presents the data and analysis relevant to each investigative question, beginning with question 1.

Question 1. Investigative Question 1 was "How are most of the communications between the SPO and user conducted, e.g., by message, phone, etc.?" This question was answered through the responses to questions 10 through 12 and 14 of the survey. A comparison of tables 15 - 17, which show the method and frequency of communication relative to the SPO, shows that the large majority of communications with the user was conducted by phone, as expected. Also, Table 18 shows that the most often used method for user-initiated communication was the phone. However, there was a statistically significant difference in the relative amount each method was used based on the location of the user (Conus or OConus). This difference was detected using a chi-square test of independence, as described in Chapter III, which applies to all further tests described in this chapter. When comparing user-initiated communication (COMTYP) with location of the user (USERLOC) in a two-way contingency table, the chi-square value was 29.6 with a prob value of 0.0, which indicates a high level of dependence.

The data indicated that split between phone, message, and face-to-face meeting for users located Conus was 75 - 15 - 10 percent, respectively. For users located overseas, the split was 51 - 45 - 4 percent.

Table 15
Frequency of Communication by Phone

PHO	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Never	10	3.4	10	3.4
Rarely	23	7.9	33	11.4
Sometimes	80	27.6	113	39.0
Almost Always	171	59.0	284	97.9
Always	6	2.1	290	100.0

Table 16
Frequency of Communication by Message

MES	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Never	16	5.5	16	5.5
Rarely	47	16.2	63	21.6
Sometimes	184	63.2	247	84.9
Almost Always	43	14.8	290	99.7
Always	1	0.3	291	100.0

The user representatives, interviewed at ASD, indicated that they communicated with SPO personnel mostly by face-to-face meetings. They stated that they communicated with

Table 17

Frequency of Communication by Meeting

MEET	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Never	8	2.7	8	2.7
Rarely	50	17.2	58	19.9
Sometimes	208	71.5	266	91.4
Almost Always	23	7.9	289	99.3
Always	2	0.7	291	100.0

Table 18

User Communicates Most Frequently By

COMTYP	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
By Phone	192	66.9	192	66.9
By Message	59	20.6	251	87.5
By Meeting	24	8.4	275	95.8
Other Method	4	1.4	279	97.2
Multi-Method	8	2.8	287	100.0

their counterparts in the field or at their respective headquarters mostly by phone.

Overall, the data showed that the largest portion of communications between SPO and user was conducted by phone, regardless of user location. However, for users located overseas, a much larger percentage of communication were conducted by message than for those located within the Conus.

Question 2. Investigative Question 2 was "How frequently do the SPO and user communicate?" This question was answered through responses to survey questions 9 and 13. Table 19 shows that 52.4 percent of the respondents said that they communicated with the user more than six times per month. Unexpectedly, 13.4 percent said that they communicated with the user less than once a month, and 2.4 percent said they never communicate with the user.

Table 19
Frequency of SPO-Initiated Communication

COMFREQ	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Never	7	2.4	7	2.4
< Once a Month	39	13.4	46	15.9
1-5 Times/Mo.	92	31.7	138	47.6
6-10 Times a Mo.	55	19.0	193	66.6
> 10 Times a Mo.	97	33.4	290	100.0

When asked how often the users initiated communications with the SPO, more than 20 percent of the respondents indicated that their users rarely or never initiated communication. Fewer than eight percent said that their users always or almost always initiated communication.

All of the user representatives indicated that they communicated with the SPO on a daily basis, and the majority stated that they communicated with their headquarters or field units at least weekly.

Question 3. Investigative Question 3 was "Do most communications follow formal or informal command channels?" This question was answered with responses from survey question 27. Additional information was provided by responses to questions 17 through 21.

Table 20
Informal Channels Are Used

INFOCOM	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Never	4	1.4	4	1.4
Rarely	19	6.8	23	8.2
Sometimes	83	29.7	106	38.0
Almost Always	138	49.5	244	87.5
Always	35	12.5	279	100.0

62 percent of the respondents indicated that requirements problems, voiced by the user, always or almost always surfaced through informal channels prior to being passed along the formal chain of command. Only 1.4 percent stated that informal channels were never used.

Not surprisingly, the user representatives working with the SPO's at ASD said that they almost always used informal channels to discuss problems. They felt strongly that informal channels were a key part of successfully resolving requirements problems.

Questions 17 through 21 dealt with the frequencies that the SPO's and users included their respective headquarters

and each other's headquarters on official message traffic. 27.5 percent of the respondents indicated that they always addressed the user's headquarters, compared with only 10.6 percent of the respondents indicating that the users always addressed the SPO's headquarters. This may indicate more willingness on the part of the user to exercise less formal channels, or it may be a result of formal direction to the SPOs to include all headquarters on their message traffic.

Question 4. Investigative Question 4 was "Does SPO and/or user acquisition experience contribute to better communication?" This question was answered by comparing questions 16, 22 and 37 to question 46. Questions 16 and 22 deal with the frequency that the user expresses dissatisfaction with some aspect of requirements implementation. Question 37 is an evaluation, by the respondents, of the overall adequacy of SPO-to-user communication, for their program. Question 46 asked how much experience the respondent had in program management (see Table 21). Since a large sample of user representatives was not used, only the attitudes and perceptions of the user representatives concerning need/applicability for acquisition experience on the part of the user are presented. No statistical analysis will be performed on the effects of user acquisition experience.

Table 21 shows that the largest respondent group (30.7 percent) had between five and ten years of experience. When the values in Table 21 were crosstabulated with the two

questions measuring frequency of communication regarding dissatisfaction, no statistically significant dependence was found between the experience level of the program manager, and the frequency of communication regarding dissatisfaction. The user representatives felt that acquisition experience on the part of the program manager was important, but that it was less important for users. They felt that after the initial shock of beginning to work with the environment of the SPO, there was not a great need for further experience. The user representatives felt that once the language of acquisition was learned, and the general systems acquisition process became familiar, actual formal experience was less valuable.

Table 21
Years Experience in Program Management

EXP	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
1/2 - 1 yr.	26	9.5	26	9.5
1 - 2	67	24.5	93	33.9
3 - 4	72	26.3	165	60.2
5 - 10	84	30.7	249	90.9
> 10	25	9.1	274	100.0

Table 22 shows that there is no statistically significant relationship between program managers' acquisition experience and their assessment of SPO/user communications.

Question 5. Investigative Question 5 was "Does having operational experience (or the lack of it) effect the program manager's ability to effectively interpret and implement requirements?" This question was answered using the data collected with survey questions 16, 22 and 47. Questions 16 and 22 are the response variables as described

Table 22

Program Manager Experience By Assessment of Comm

EXP(Years Experience)						
ASESMENT(Assessment of Communications)						
FREQUENCY	Very Poor	Poor	Average	Good	Very Good	TOTAL
1/2 - 1 yr.	2	4	6	11	3	26
1 - 2	1	4	19	23	18	65
3 - 4	1	4	23	29	13	70
5 - 10	1	6	21	35	20	83
> 10	0	0	7	13	5	25
TOTAL	5	18	76	111	59	269
CHI-SQUARE = 15.455 PROB VALUE = 0.492						

above and in Chapter III. Question 47 asks what operational experience, if any, the respondent has had (see Table 12).

Comparing the relationship between the operational experience of respondents to the frequency with which their users voice dissatisfaction yields an unexpected result.

Table 24

Operational Experience By SPO Assessment Of Communication

EXPSUM(Summary of Operational Exp of Managers)						
ASESMENT(Assessment of Communications)						
FREQUENCY	Very Poor	Poor	Average	Good	Very Good	TOTAL
OPER	2	6	34	37	28	107
NON-OPS	4	12	47	83	33	179
TOTAL	6	18	81	120	61	286
CHI-SQUARE = 4.986 PROB VALUE = 0.289						

The lack of a relationship between the respondents' operational experience and the frequency with which their users voice dissatisfaction may indicate that operational experience is not as important as most of the user representatives state. A more likely explanation is that the measures of dissatisfaction provided by survey questions 16 (variable UDISSAT) and 22 (variable DISAT) are biased because the respondents are program office personnel. This is addressed further in Chapter V.

Question 6. Investigative Question 6 was "Does physical separation of the SPO and the user's main operating location interfere with communications?" This question was answered by examining responses to survey questions 4 and 5, and comparing them with reported user dissatisfaction. Tables 25 and 26 summarize user locations, and Table 27 shows a

crosstabulation between Conus/Oconus user location and the frequency with which the user expressed dissatisfaction. There is no statistical relationship between the two. This is representative of the results of crosstabulations between all dissatisfaction measures and all questions regarding

Table 25
User Located ConUS or OConUS

USERLOC	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Within ConUS	178	61.2	178	61.2
OConUS	55	18.9	233	80.1
Both	58	19.9	291	100.0

Table 26
Location of Conus User

CONUSLOC	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Same Base	13	5.5	13	5.5
Within 1000mi	73	31.1	86	36.6
More than 1000mi	111	47.2	197	83.8
Near and Far	38	16.2	235	100.0

user location. This agrees with the opinions expressed by the user representatives interviewed. The majority of them stated that the location of the ultimate user did not impact the communication of requirements.

Table 27

User Location By Frequency of Dissatisfaction Communication

USERLOC(ConUS or OConUS)						
DISAT(Frequency User expresses Dissatisfaction)						
FREQUENCY			Some-	Almost		
	Never	Rarely	times	Always	Always	TOTAL
-----+-----+-----+-----+-----+-----+-----						
Within ConUS	9	66	82	16	1	174
-----+-----+-----+-----+-----+-----+-----						
OConUS	1	16	32	3	1	53
-----+-----+-----+-----+-----+-----+-----						
Both	4	25	22	6	0	57
-----+-----+-----+-----+-----+-----+-----						
TOTAL	14	107	136	25	2	284
-----+-----+-----+-----+-----+-----+-----						
CHI-SQUARE = 7.98			PROB VALUE = 0.436			

Question 7. Investigative Question 7 was "Do travel constraints such as limited TDY funding interfere with communications?" This question was answered with data from survey question 36. Question 36 asked if the unavailability of TDY funds adversely affected the communication of requirements. 68.2 percent of the respondents answered that lack of TDY funds either rarely or never hindered the requirements communications process (Table 28). The user representatives, however, were divided on this issue, with about half of those with an opinion saying that TDY funding had no effect and the other half stating that more TDY funds for both users and SPO's would enhance communications.

Table 28

Effect of TDY Funds on Communications

TDYFUND	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
Never	110	38.5	110	38.5
Rarely	85	29.7	195	68.2
Sometimes	71	24.8	266	93.0
Almost Always	19	6.6	285	99.7
Always	1	0.3	286	100.0

Other Findings

In addition to the analysis performed to answer the stated investigative questions, the data were analyzed to see if any other statistically significant relationships existed between any of the other variables. The additional analyses yielded interesting results in the following areas.

- Single System versus Basket SPO's
- User initiated communications
- The number of requirements changes in the past year
- The respondents' perceived need for a user representative
- Acquisition training

The additional results are presented in the order listed above.

SPO Type. The variable which identified the type of SPO the respondent was from (SPOTYP) was compared against the remaining dependent variables, and the following statistically significant relationships were identified.

First, the data indicate that respondents who work in basket SPO's tend to communicate more frequently by phone than those who work in single system SPO's (Table 29). Another statistically significant relationship which may help to explain why basket SPO's communicate with the user more by phone is the relationship between type of SPO and whether or not a user representative is permanently assigned as part of the SPO team. This crosstabulation is shown in

Table 29
Type of SPO by Phone Communication Frequency

SPO(Single System or Basket SPO)		PHO(Comm percentage by Phone)					
FREQUENCY		Never	Rarely	Some- times	Almost Always	Always	TOTAL
Single Sys SPO		4	8	44	58	2	116
Basket SPO		6	13	28	83	2	132
TOTAL		10	21	72	141	4	248
CHI-SQUARE = 8.582		PROB VALUE = 0.072					

Table 30, which demonstrates that there is a strong relationship. Single system SPO's are much more likely to have a user representative permanently assigned to them than are basket SPO's. This makes sense, because the dollar value associated with a single system SPO's program tends to be higher; and, therefore, the program is viewed as more

important to the user. And if there is a user working in the building with a respondent, they are more likely to talk face-to-face than over the phone.

Table 30
Type of SPO by User Rep in SPO

SPO(Single System or Basket SPO)
USERREP(User Representative in SPO?)

FREQUENCY	Yes	No	TOTAL
Single Sys SPO	89	28	117
Basket SPO	69	60	129
TOTAL	158	88	246

CHI-SQUARE = 13.615 PROB VALUE = 0.000

Along the same line of thought, the next table (Table 31) shows just the opposite relationship for face-to-face meetings. Single system SPO's are more likely to have meetings than are basket SPO's.

The differences between single system SPO's and basket SPO's seemed to be keyed to the fact that single system SPO's are more likely to have a user representative assigned.

User Initiated Communication. The data indicate that there is a strong relationship between the frequency of user initiated communications and the perceived frequency that

Table 31
Type of SPO BY Meeting

SPO(Single System or Basket SPO)						
MEET(Comm percentage by Meeting)						
FREQUENCY	Never	Rarely	Some- times	Almost Always	Always	TOTAL
Single Sys SPO	3	18	79	16	1	117
Basket SPO	4	18	104	5	1	132
TOTAL	7	36	183	21	2	249
CHI-SQUARE = 8.447 PROB VALUE = 0.077						

user communications deal with some aspect of dissatisfaction with requirements (Table 32). This is logical in that if the users are satisfied they will be less likely to call the SPO, than if they disagree with the way requirements interpretations are being carried out. The user representatives added credence to this by stating that if there is some problem in requirements implementation, they talk to the managers and project engineers, and keep talking to them until the problem is resolved. As expected, when things are going smoothly, there is less incentive to keep up with frequent communications.

Number of Requirements Changes. Corresponding to the above observations about user initiated communication, there is a relationship between the number of requirements changes on a program and the overall frequency with which SPO/user

communication occurs. Generally, as the number of changes increase the communication frequency between SPO and user also tends to increase. This is not to say that one causes the other, only that they are related.

Table 32

Freq of User Initiated Communication By
Frequency of User Comm Dealing with Dissatisfaction

USERINT(Freq of User Initiated Comm)						
UDISSAT(Comm percentage RE Dissatisfaction)						
FREQUENCY						
	Never	Rarely	Some- times	Almost Always	Always	TOTAL
Never	1	0	3	1	0	5
Rarely	6	22	22	3	2	55
Sometimes	3	57	108	32	5	205
Almost Always	0	2	14	6	0	22
Always	0	0	0	0	1	1
TOTAL	10	81	147	42	8	288

CHI-SQUARE = 66.832 PROB VALUE = 0.000

Perceived Need for User Representative. An interesting result of this exploratory analysis was that respondents who work in a SPO which had a user representative were much more likely to say that having a user representative was beneficial than those respondents who work in SPO's without user representation. In fact, those who worked in SPO's

without permanently assigned user representation were more likely to say that having a user representative would not aid in the communication of system requirements (see Table 33). Not unexpectedly, all of the users representatives (who, of course, are currently working in SPO's) said that it was very important to have direct user representation at every stage of the acquisition process.

Table 33
Perceived Need for User Rep By
User Rep in SPO

URNEED(Need for User Rep)
USERREP(User Representative in SPO?)

FREQUENCY	Yes	No	TOTAL
-----+-----+-----+			
Yes	23	52	75
-----+-----+-----+			
No	7	62	69
-----+-----+-----+			
TOTAL	30	114	144

CHI-SQUARE = 9.176

PROB VALUE = 0.002

Acquisition Training. Several interesting relationships surfaced in the area of what type of acquisition training, and how much of it, respondents had received. Out of all of the training for acquisition personnel, the one course which is related to the factors measured in this research is AFIT Systems 100. None of the other courses, including the introductory course at System Acquisition School, AFIT

Systems 200, AFIT Systems 400, and DSMC, seemed to be related to the way respondents answered any of the other survey questions, except rank and number of personnel supervised. It is particularly interesting to note that if respondents had completed Systems 100, they were much more likely to state that a user representative would benefit the communications process, than if they had not had the course (see Table 34).

Table 34

Completed Systems 100 By
Perceived Need for User Rep

SYSONE(Systems 100)				
URNEED(Need for User Rep)				
FREQUENCY				
		Yes	No	TOTAL
-----+-----+-----+-----+-----				
Yes	50	26		76
-----+-----+-----+-----+-----				
No	25	43		68
-----+-----+-----+-----+-----				
TOTAL	75	69		144
CHI-SQUARE = 12.115				
PROB VALUE = 0.001				

Another interesting link to Systems 100, that is also not evident for any of the other acquisition courses, is to the respondents' assessment of the overall SPO-to-user communication process. If the respondents had completed Systems 100, they were much more likely to make a very

positive assessment of the state of communications than if they had not taken the course (see Table 35). The data does not indicate that the actual state of communications was any better or worse for the two categories of respondents, but their attitudes are certainly different.

As was briefly mentioned above in the discussion of investigative question 4, the users representatives almost all agree that some acquisition experience, on their part would be beneficial. The same is true of their responses concerning acquisition training. Most of the user representatives feel that the communication of requirements would be enhanced if they received some acquisition training (but not too much).

Table 35

Completed Systems 100 By Assessment of Communications

SYSONE(Systems 100)						
ASESMENT(Assessment of Communications)						
FREQUENCY	Very				Very	
Poor	Poor	Average	Good	Good	TOTAL	
Yes	4	6	46	59	40	155
No	2	12	35	62	21	132
TOTAL	6	18	81	121	61	287
CHI-SQUARE = 8.363 PROB VALUE = 0.079						

V. Conclusions and Recommendations

Introduction

This chapter summarizes the relevant results of the data analysis, suggests what the implications of those results might be, identifies possible limitations of the study, and makes recommendations for further research in the area of communication of requirements from the user to the SPO during the ongoing systems development process.

Relevant Results

The results of this study showed that, as expected, most of the communications between the user and the SPO are conducted by phone, and that basket SPO's use the phone even more frequently than do single system SPO's. This more frequent use of the phone by basket SPO's seems to be related to the fact that more single system SPO's have user representatives present, thus reducing the need to call the user's headquarters or field units to clarify requirements.

Surprisingly, analysis of the data showed that 15.8 percent of the respondents communicated with their user either less than once a month or never. On the other end of the spectrum, 33.4 percent communicated with their user more than ten times per month. The majority of the user representatives working at ASD, who were contacted, reported, not unexpectedly, that they communicated with their respective SPO's on a daily basis. The frequency of

SPO-initiated communications did not appear to be related to the number of requirements-related changes on the program. On the other hand, the frequency of user-initiated changes was positively related to the number of requirements changes on a program.

The relationship between the amount of informal versus formal communication and the frequency users voiced dissatisfaction was not statistically significant. This may indicate that requirements problems will finally be surfaced without regard for whether they are surfaced through formal or informal channels. This study does not show, however, that the problems will be surfaced in as timely a manner through formal channels as through informal ones. This variable was not considered, and no data was collected on it.

The frequency with which the users voiced dissatisfaction with requirements implementation was not statistically related to the acquisition experience level of the program manager. Operational experience on the part of the program manager was also not related to the frequency of users expressing dissatisfaction. One likely explanation for this unexpected lack of relationship between operational experience and dissatisfaction is that the measure of dissatisfaction is biased, because it is being reported by SPO personnel.

Niether physical separation of SPO and user nor limited TDY funds were related to any measure of requirements

communication. Also, the majority of respondents stated that lack of TDY funds was rarely or never a problem.

AFIT Systems 100 was the only acquisition course which was related to the respondents' perceived need for, and value of, a user representative being permanently assigned to the SPO. This course was also positively related to the respondents' assessment of the state of the requirements communication process. If the respondents had completed Systems 100, they were much more likely to give an assessment of 'good' or 'very good,' than if they had not taken the course.

Implications

The general consensus, as developed from the comments on the surveys and interviews, of the participants in this study is that more operational experience on the part of the program/project managers and more acquisition experience on the part of users will positively influence the communication of system requirements from the users to the SPO. The data collected, however, do not bear this out. As stated above there was no statistical relationship between the two. This seems counterintuitive and may be a result of the limitation discussed below.

Therefore the major, and only statistically significant, implication of this study is that, possibly, the more people involved in the systems acquisition process who can be put through the AFIT Systems 100 course, the more positive will

be the acceptance of user representation in the SPO's, and the more effective will be the communication process. However, this may not be the case, since the positive relationship between Systems 100 and perceived need for a user representative which was demonstrated in Chapter IV does not show that the variables are causally related. Causality has not been shown, but it may be a reasonable conclusion.

Limitations

In Chapter III the key dependent variable was identified as the effective communication of the users' system requirements to the SPO, and was operationally defined in terms of the frequency of the users voicing dissatisfaction to the SPO about problems with system requirements implementation. This measure of communications effectiveness is limited because of the bias introduced by having program management personnel report the frequency with which the users on their own programs are expressing dissatisfaction. This is true because there is likely a tendency on the part of some program managers to understate the frequency which their users are expressing dissatisfaction, out of a desire to present themselves and their programs in the best possible light.

Also, as addressed in Chapter I, the data obtained were self-reported perceptions from individual program management personnel responding to the survey instrument at Appendix A.

The analysis and results should be viewed in light of these possible limitations.

Recommendations for Further Research

Further research in this area should be directed towards identifying a good measure of requirements communications between the user and the SPO.

One area which may yield useful information is determining the impact of the use of informal versus formal channels on not only the success of requirements communications, but also on the program schedule.

Finally, a study should be conducted in which the program managers' responses are paired with their users' responses to see if any significant differences exist in the way each group views the process. A study of this nature might yield information which could be used to improve and streamline the system requirements communication process.

Appendix A: Survey Instrument



DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY
WRIGHT-PATTERSON AIR FORCE BASE OH 45433-6583

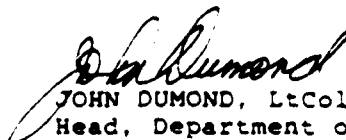
REPLY TO
ATTN OF LSY (Capt Smariga, AUTOVON 785-6569)

10 MAY 1987

SUBJECT System Requirements Survey Package - USAF SCN 87-56

TO Survey Participant

1. The communication of weapon system requirements from the ultimate user to the System Program Office (SPO) is critically important to the successful development of effective weapon systems.
2. The enclosed survey is designed to measure which factors in the ongoing communication process between the user of the weapon system and the SPO are most important, and where potential problems may be. The data gathered will become part of an AFIT research project and may influence the SPO-to-user communication process if significant problems are found.
3. Please take the time to complete the enclosed survey and return it in the enclosed envelope by 22 May 1987.
4. Your participation is completely voluntary, but we would certainly appreciate your help. For further information, please contact Capt. Russ Smariga at AUTOVON 785-6569.


JOHN DUMOND, LtCol, USAF
Head, Department of Systems
Acquisition Management
School of Systems and Logistics

2 ENCL
1. Survey
2. Return
Envelope

STRENGTH THROUGH KNOWLEDGE

USAF SCN 87-56

Field Survey

Investigating

THE COMMUNICATION OF THE USER'S REQUIREMENTS
TO THE SYSTEM PROGRAM OFFICE DURING THE ONGOING
SYSTEM DEVELOPMENT PROCESS

Your responses, suggestions and comments will be completely **anonymous**. No attempt will be made to identify any individual responding to the survey.

Please respond as accurately and truthfully to each question as possible.

Any overall comments on the survey may be provided on the back of the last page, or on additional paper.

Please keep the following definitions in mind as you complete the survey.

User - a member a the organization which will ultimately receive and operate the system which is being developed or procured by your System Program Office (SPO) team.

Requirement Change - either a change in the interpretation of a requirement as stated in formal direction (PMD, SON, etc.), or an actual change in stated requirements.

Contract Change - any change to the agreement between the government and the system development contractor which results in a change in the requirements for the deliverable end item.

SPO/User Communication Survey

Please indicate your response by circling the letter of the **BEST** answer for each question. Questions where more than one response is appropriate are so noted.

1. How would you classify the SPO in which you work?
 - a. Single System SPO
 - b. Basket SPO
 - c. I currently work as a Systems Technical Officer
 - d. I currently work as a Program Element Monitor
 - e. I am not involved in Systems Acquisition - Stop Now, please return the survey in the envelope provided.
2. What is the current phase of your program? (Circle more than one if you manage programs which are in different phases.)
 - a. Concept Exploration
 - b. Demonstration/Validation
 - c. Full-Scale Development
 - d. Production/Deployment
 - e. Post Production/Modification
3. What is the estimated total cost (including production) of the program(s) for which you are responsible?
 - a. Less than \$100,000
 - b. \$100,000 to \$999,999
 - c. \$1,000,000 to \$29,999,999
 - d. \$30,000,000 to \$99,999,999
 - e. \$100,000,000 or more
4. Is the primary user for which your system is being developed located:
 - a. Within the Continental United States (ConUS)
 - b. Outside the Continental United States (OConUS)

If the user is located ConUS, please answer 5 & 6 below, otherwise skip to 7.

5. Is the user located:
 - a. At the same base as your assigned base
 - b. Within 1000 miles of your assigned base
 - c. More than 1000 miles from your assigned base

6. Is the user a part of:

- | | |
|--------|---------------------------------|
| a. SAC | f. AFCC |
| b. TAC | g. AFLC |
| c. MAC | h. AFSC |
| d. ESC | i. Other (Please Specify) _____ |
| e. ATC | |

7. If the user is located OConUS, is the user part of:

- a. USAFE
- b. PACAF
- c. Other (Please Specify) _____

8. Is the primary end user of the system:

- a. A headquarters (ATC, TAC, etc.)
- b. A field unit
- c. Other (Please Specify) _____

9. How often do you communicate directly (by phone, message, meeting, etc.) with the user?

- a. Never
- b. Less than once a month
- c. 1-5 times a month
- d. 6-10 times a month
- e. More than 10 times a month

10. How frequently are your communications with the user conducted by phone?

- a. Never
- b. Rarely
- c. Sometimes
- d. Almost Always
- e. Always

11. How frequently are your communications with the user conducted by official message traffic?

- a. Never
- b. Rarely
- c. Sometimes
- d. Almost Always
- e. Always

12. How frequently are your communications with the user conducted by face-to-face meetings?

- a. Never
- b. Rarely
- c. Sometimes
- d. Almost Always
- e. Always

13. How often does the user initiate communications with you?

- a. Never
- b. Rarely
- c. Sometimes
- d. Almost Always
- e. Always

14. Does the user most often initiate communications by:

- a. Phone
- b. Official Message Traffic
- c. Face-to-face meeting
- d. Some other method (Please Specify) _____

15. How frequently do communications which the user initiates concern some aspect of developing and/or refining system requirements?

- a. Never
- b. Rarely
- c. Sometimes
- d. Almost Always
- e. Always

16. How frequently do communications which the user initiates relate to some dissatisfaction with system requirements as they are being implemented, or some deficiency perceived by the user?

- a. Never
- b. Rarely
- c. Sometimes
- d. Almost Always
- e. Always

17. How frequently does official message traffic to the user, initiated by the SPO, have either HQ AFSC or HQ USAF as an information (or joint action) addressee?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
18. How frequently does official message traffic to the user, initiated by the SPO, have the user's higher headquarters, e.g. HQ USAFE/XPP, as an information (or joint action) addressee?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
19. How frequently does official message traffic from the user have HQ AFSC or HQ USAF as an information (or joint action) addressee?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
20. How frequently does official message traffic from the user have the user's higher headquarters as an information (or joint action) addressee?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always

21. How frequently are communications which the SPO initiates routed first to HQ AFSC (or HQ USAF) and the user's higher headquarters before the user is directly contacted?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
22. How often has the user expressed dissatisfaction with the adequacy of system requirements implementation?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
23. How frequently does the user's expression of dissatisfaction result in a requirement change to the program?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
24. How frequently do user initiated requirement changes necessitate contractual changes?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
25. What is the average cost to the program incurred due to user initiated changes?
- a. less than \$10,000
 - b. \$10,000 to \$19,999
 - c. \$20,000 to \$49,999
 - d. \$50,000 to \$99,999
 - e. More than \$100,000

26. How frequently do user initiated requirements changes result in saving money for the program?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
27. How frequently does the user first communicate his/her dissatisfaction with requirements implementation through informal communication channels, versus formal channels?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always
28. Over the past year how many user initiated requirements changes have been implemented with which you have been involved?
- a. None
 - b. 1 - 2
 - c. 3 - 4
 - d. 5 - 10
 - e. More than 10
29. Does the SPO always wait for formal direction from HQ AFSC before implementing user initiated requirements changes?
- a. Yes
 - b. No
30. If not, how frequently are user initiated requirements changes held from implementation until formal direction is received?
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Almost Always
 - e. Always

31. Is the decision to withhold a change until formal direction from higher headquarters is received based on the dollar value of the change, or some other factor?

- a. Dollar value of the change
- b. Some other factor
- c. Not applicable

32. If the decision to withhold a change until formal direction is received is based on a dollar amount, what is the threshold dollar amount?

33. Does your SPO have a representative of the user permanently assigned as a member of the program team?

- a. Yes
- b. No

34. If yes, how often has the user representative been effective at clarifying or expediting the clarification of questions regarding the implementation of requirements?

- a. Never
- b. Rarely
- c. Sometimes
- d. Almost Always
- e. Always

35. If you do not have a user representative permanently assigned, do you feel that having one would significantly improve the process of requirements implementation?

- a. Yes
- b. No

36. How frequently has the availability/unavailability of TDY funding adversely affected the communication of requirements from the user to the SPO?

- a. Never
- b. Rarely
- c. Sometimes
- d. Almost Always
- e. Always

37. Overall, do you feel that communications between the SPO and the user have been:
- a. Very Poor
 - b. Poor
 - c. Average
 - d. Good
 - e. Very Good
38. Do you feel that increased communications between the using command headquarters and the SPO would help or hinder the communication of system requirements to the SPO?
- a. Help
 - b. Hinder
 - c. Neither Help nor Hinder
39. Do you feel that increased communications between the field user and the SPO would help or hinder the communication of system requirements to the SPO?
- a. Help
 - b. Hinder
 - c. Neither Help nor Hinder
 - d. There is no field user
40. For which Product Division do you work?
- a. Aeronautical Systems Division
 - b. Electronic Systems Division
 - c. Space Division
 - d. Armament Division
 - e. Aerospace Medical Division
 - f. Ballistic Missile Office
 - g. Other (Please Specify) _____
41. What is your current rank?
- a. 2LT
 - b. 1LT
 - c. CAPT
 - d. MAJ
 - e. LTCOL
 - f. COL
42. What is the highest academic degree you hold?
- a. Bachelor's Degree
 - b. Master's Degree
 - c. Doctoral Degree

43. In what field(s) is(are) your degree(s)? (Check all that apply.)

- a. Electrical Engineering
- b. Aeronautical/Aerospace Engineering
- c. Mechanical Engineering
- d. Other Engineering (Please Specify) _____
- e. Business/Management
- f. Science/Math
- g. Fine Arts
- h. History
- i. Other (Please Specify) _____

44. Are you a:

- a. SPO Director (Chief of a SPO - may be a single program manager.)
- b. Program Manager (Single manager of a complete system - may have project managers as subordinates.)
- c. Project Manager (Manager for a system sub-component.)
- d. Systems Technical Officer
- e. Program Element Monitor
- f. Deputy SPO Director
- g. Manager of several project managers who each manage separate projects
- h. Configuration/Data manager
- i. Project engineer
- j. Test manager
- k. Other (Please Specify) _____

45. How many people do you directly supervise?

- a. none
- b. 1-2
- c. 3-4
- d. 5-10
- e. more than 10

46. How many years cumulative experience do you have as a program manager?

- a. 1/2 - 1
- b. 1 - 2
- c. 3 - 4
- d. 5 - 10
- e. more than 10

47. Have you served an operational tour?
- a. Yes, in:
 - 1) Rated position
 - 2) Maintenance position
 - 3) Missile operations position
 - 4) Space operations position
 - 5) Other (Please Specify) _____
 - b. No
48. With respect to making the decision to implement a required change on the program with which you are related, would you say that you:
- a. Have no input to the decision process
 - b. Have some limited input to the decision process
 - c. Provide about half of the input on which the decision is based
 - d. Provide most of the input
 - e. Are the final authority and make the decision
49. Which of the following Professional Military Education courses have you completed? (Circle all that apply.)
- a. Squadron Officer School (Correspondence)
 - b. Squadron Officer School (Residence)
 - c. Air Command and Staff College (Correspondence/Seminar)
 - d. Air Command and Staff College (Residence)
 - e. Air War College (Correspondence/Seminar)
 - f. Air War College (Residence)
 - g. Industrial College of the Armed Forces
 - h. Other (Please Specify) _____
50. Which of the following Acquisition Program Management training courses have you completed? (Circle all that apply.)
- a. AFIT Systems 100
 - b. AFIT Systems 200
 - c. AFIT Systems 400
 - d. Systems Acquisition School (Brooks AFB)
 - e. Defense Systems Management College
 - f. Other DoD Program Management Course(s) (Please Specify) _____
 - g. Non-DoD Program Management Course(s) (Please Specify) _____

Please include any further comments in the space below, or on additional paper.

Thank you for your time and for the information which you have provided.

.....
PLEASE RETURN THIS SURVEY IN THE ENVELOPE PROVIDED.
.....

Appendix B: Selected Comments from Survey Responses

Greatest difficulty experienced in communicating with the using Command is the lack of an official focal point in the using Command, and the problem is dealing with many disinterested user members "strap hangers" as opposed to meeting regularly with a knowledgeable action officer who can speak for and make commitments for the user. New uninformed participants at each and every meeting waste untold time in reinventing the wheel, and then they make decisions, carrying into back to the "black wall" for staffing. This also applies to other Government user participants in program development. We have an overabundance of committees and at extreme is K-12. The barriers to communication are almost insurmountable.

Standard set of work is not up and measurement of the Assessment groups are not used. Since the system is in the test.

The need for more information is not being met.

Many of the staff are not interested in the program. The new staff are not interested in the program. The staff are not interested in the program.

The staff are not interested in the program.

The staff are not interested in the program.

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The staff are not interested in the program.

The staff are not interested in the program.

The staff are not interested in the program.

Training is hard to get due to full time work requirements.

System acquisition varies . . . because programs contracted out have unstable funding. The key is to maintain funding - users cannot help with this.

Complex? - You bet! Political? - In spades!!

There is a reluctance for the user to say they don't understand and also their naivete is sometimes exploited through disinformation.

Problem is with initial user requirements prior to contract award. The using command has failed . . . to adequately think through their requirement, and to assess the technical feasibility.

This SPO has difficulty getting the user to formalize requirements - lots of verbal guidance, but won't put it in writing.

When dissatisfaction with a program is an issue, it is usually the SPO who is dissatisfied because of the perceived low return on investment to satisfy the last little bit of the user's requirements. The general thrust becomes one of getting the users to back off on wanting everything. We have been reasonably successful in reaching cost effective balances between cost and performance.

Testers are causing the most problems.

We have had many problems in our program because our user is very resistant to commit to specific requirements. They prefer instead to allow the SPO to postulate endless "what if" scenarios which they can not agree or agree with as the program is built.

There seem to be several problems with the power to say "no" to the user's demands, as in a given instance.

AF is involved in a system Acquisition program effort for an Air Force wide computer D W and C W system with functions for maintenance and programmer personnel with a significant experience. AF is XX is already very late in the acquisition.

The question is how often we communicate with rather than if we communicate. The attitudes of the SPO and the user are such that it is difficult to get the user to agree to a plan. We are trying to get a total stage of contract and a new contract for the system. We are going to have to make their whole strategy.

Consider using electronic mail.

I strongly feel that frequent, complete communications would solve an awful lot of our problems. Most of the known obstacles can be overcome - it's the surprises that kill us.

I believe that my operational flying experience (19 years) prior to being involved in acquisition management provided me with a keener insight and interpretation of the user's SON.

I believe that having a user representative would facilitate the information flow, but would hinder the decision making process because it adds another layer of bureaucracy.

SPO's could benefit greatly from listening more carefully to the testing community. They could fix more problems earlier if this were more often the case.

Bottom line: Systems must meet real user requirements or the system should be trashed.

Too much emphasis placed on PME. Let us do our jobs

We do not coordinate system requirements with field units, thereby avoiding confusion resulting from disinformation between headquarters and field units.

The user most often initiates communications by generals yelling at each other.

A group of sergeants from the field have caused me to kill a forest in letter and message traffic trying to "help" me with a decision.

The user is reluctant to specify requirements other than in general terms.

The user sometimes hedges on signing up to specifications.

User changes his mind frequently (usually when old players PCS and new folks come on board).

Often the user doesn't know how to employ the system until well into the test program.

Appendix C: SAS Computer Program
for Data Analysis

```
options linesize=78;
proc format;
  value jobfmt 1='Single Sys SPO'
              2='Basket SPO'
              3='Work as SYSTO'
              4='Work as PEM'
              5='Not Involved';
  value spotmt 1='Single Sys SPO' 2='Basket SPO';
  value phasetmt 1='Concept Exp Phase'
                2='Dem/Vai Phase'
                3='FSD Phase'
                4='Production Phase'
                5='Post Prod/Mod'
                6='Early Mixed'
                7='Mid Mixed'
                8='Late Mixed'
                9='Mixed';
  value costfmt 1='Less than $100K'
               2='100K - 999K'
               3='1M - 9.9M'
               4='10M - 99.9M'
               5='100M or more';
  value locfmt 1='Within ConUS' 2='OConUS' 3='Both';
  value distfmt 1='Same Base' 2='Within 1000mi'
               3='More than 1000mi'
               4='Near and Far';
  value mdmt 1='User is SAC'
            2='User is TAC'
            3='User is MAC'
            4='User is ESC'
            5='User is ATC'
            6='User is AFCC'
            7='User is AFLC'
            8='User is AFSC'
            9='Some Other User'
            10='Mutiple Users';
  value contmt 1='User is USAFE'
              2='User is PACAF'
              3='Other OCONUS User'
              4='Multi-User';
  value userfmt 1='User is HQ'
               2='Field Unit'
               3='Other'
               4='HQ and Field';
  value comfmt 1='Never'
              2='< Once a Month'
              3='1-5 Times/Mo.'
              4='6-10 Times a Mo.'
              5='> 10 Times a Mo.';
```

value respfmt 1='Never'
 2='Rarely'
 3='Sometimes'
 4='Almost Always'
 5='Always';
 value methfmt 1='By Phone'
 2='By Message'
 3='By Meeting'
 4='Other Method'
 5='Multi-Method';
 value chngfmt 1='< 10K'
 2='10K - 19K'
 3='20K - 49K'
 4='50K - 99K'
 5='> 100K';
 value supfmt 1='None'
 2='1 - 2'
 3='3 - 4'
 4='5 - 10'
 5='More Than 10';
 value yesnofmt 1='Yes' 2='No';
 value changfmt 1='Dollar Value'
 2='Other Factor'
 3='N/A';
 value poorfmt 1='Very Poor'
 2='Poor'
 3='Average'
 4='Good'
 5='Very Good';
 value hhnfmt 1='Help'
 2='Hinder'
 3='Neither';
 value hhnffmt 1='Help'
 2='Hinder'
 3='Neither'
 4='No Field User';
 value divfmt 1='ASD' 2='ESD' 3='SD' 4='AD' 5='AMD' 6='BMC'
 7='Other';
 value rankfmt 1='2LT' 2='1LT' 3='CAPT' 4='MAJ' 5='LTCOL'
 6='COL';
 value degrfmt 1='Bachelor"s' 2='Master"s' 3='Doctoral';
 value typefmt 1='Engineering' 2='Sci/Math' 3='Non-Tech'
 4='Other' 5='Multiple';
 value titlfmt 1='SPO Director'
 2='Pgm Mgr'
 3='Prj Mgr'
 4='SYSTO'
 5='PEM'
 6='Dep SPO Dir'
 7='Mgr Of Prj Mgrs'
 8='Config/Data Mgr'
 9='Proj Engr'
 10='Test Mgr'

```

        11='Other';
value expfmt 1='1/2 - 1 yr.'
              2='1 - 2'
              3='3 - 4'
              4='5 - 10'
              5='> 10';
value operfmt 1='Rated' 2='Maintenance' 3='Missile' 4='Space'
              5='Other Ops' 6='None' 7='Multiple';
value decistmt 1='No Input'
               2='Some Input'
               3='Half Input'
               4='Most Input'
               5='All Input';
value pmetfmt 1='SOS' 2='ACSC' 3='AWC' 4='ICAF'
              5='SOS & ACSC' 6='SOS & AWC'
              7='SOS & ICAF' 8='SOS, ACSC, AWC'
              9='ALL' 10='OTHER' 11='NONE';
value schfmt 1='SYS100' 2='SYS200' 3='SYS400' 4='DSMC'
             5='SYS100 & SYS200' 6='ALL SYS' 7='SYS & SAS'
             8='SYS & DSMC' 9='SAS & DSMC' 10='ALL TYPES'
             11='NONE' 12='SAS' 13='MULTI';
value expstfmt 1='OPER' 3='NON-OPS';
value stafmt 1='SYSTO' 2='PEM';
value hqfldfmt 1='HQ' 2='Field Unit';
data init;
  infile real;
  input spotyp 1 phase 2 cost 3 userloc 4 conusloc 5 usercmd
        6-7 oconuser 8 usertyp 9 comfreq 10 pho 11 mes 12 meet 13
        userint 14 comtyp 15 comreq 16 udissat 17 hqcom 18 uhqcom
        19 ucomhq 20 ucomuhq 21 comhqu 22 disat 23 dischang 24
        ktrchang 25 deltcost 26 savings 27 infocom 28 numchang 29
        formdir 30 chanhold 31 criteria 32 amount 33-35 userrep
        36 urephlp 37 urneed 38 tdyfund 39 asesment 40 mcomuhq 41
        mcomfld 42 proddiv 43 rank 44 degree 45 degtyp 46 title
        47-48 numsup 49 exp 50 rated 51 decinput 52 sosc 53 sosr
        54 acscc 55 acscr 56 awcc 57 awcr 58 icaf 59 other 60 pme
        61-62 sysone 63 systwo 64 sysfour 65 sas 66 dsmc 67 odod
        68 ondod 69 school 70-71;
    if 1<=rated<=5 then expsum=1;
    else if rated=7 then expsum=1;
    else if rated=6 then expsum=3;
    if spotyp=1 then spo=1;
    else if spotyp=2 then spo=2;
    else if spotyp=3 then staff=1;
    else if spotyp=4 then staff=2;
    if usertyp=1 then usrsum=1;
    else if usertyp=2 then usrsum=2;
label    spotyp='Type of SPO or Job'
          staff='SYSTO or PEM'
          phase='Phase of Program'
          cost='Total Program Cost'
          userloc='ConUS or OConUS'
          conusloc='Location of Conus User'

```

usercmd='Command of the User'
 oconuser='Command of OConUS User'
 usertyp='Field or Headquarters User'
 comfreq='Frequency of Communication'
 pho='Comm percentage by Phone'
 mes='Comm percentage by Message'
 meet='Comm percentage by Meeting'
 userint='Freq of User Initiated Comm'
 comtyp='User Communicates By'
 comreq='Comm Concerning Requirements'
 udissat='Comm percentage RE Dissatisfaction'
 hqcom='Percentage of SPO Comm addressing HQ'
 uhqcom='SPO Comm addressing User HQ'
 ucomhq='User Comm addressing HQ'
 ucomuhq='User Comm addressing User HQ'
 comhqu='SPO Comm routed First to HQ'
 disat='Frequency User expresses Dissatisfaction'
 dischang='Perc of time Dissat results in Change'
 ktrchang='Perc of time Contractual Changes Req'd'
 deltcost='Average Cost of Each Change'
 savings='Perc of User Changes Which Save Money'
 infocom='Informal Channels Are Used'
 numchang='Number of Changes in Past Year'
 formdir='SPO Waits for Formal Direction'
 chanhold='Perc of Changes Held for Formal Dir'
 criteria='Decision to Hold based on'
 amount='Dollar Amount of Criteria'
 userrep='User Representative in SPO?'
 urephlp='User Rep Effectiveness'
 urneed='Need for User Rep'
 tdyfund='Effect of TDY Funds'
 asesment='Assessment of Communications'
 mcomuhq='More SPO to User HQ Comm'
 mcomfld='More SPO to Field User Comm'
 proddiv='Product Division Involved'
 rank='Rank of Respondent'
 degree='Type of Degree held'
 degtyp='Area of Specialization'
 title='Type of Position by Title'
 numsup='Number of People Supervised'
 exp='Years Experience'
 rated='Operational Experience'
 decinput='Amount of Input Into Decision Process'
 sosc='SOS by Correspondence'
 sosr='SOS in Residence'
 acsc='ACSC by Correspondence'
 acscr='ACSC in Residence'
 awcc='AWC by Correspondence'
 awcr='AWC in Residence'
 icaf='Industrial College of the Armed Forces'
 other='Other PME'
 pme='PME Summary'
 sysone='Systems 100'

```

systwo='Systems 200'
sysfour='Systems 400'
sas='Systems Acquisition School'
dsmc='Defense Systems Management College'
odod='Other DoD Pgm Mgt Courses'
ondod='Other Non-DoD Pgm Mgt Courses'
school='Acquisition Educ Summary'
expsum='Summary of Operational Exp'
spo='Single System or Basket SPO'
usrsum='Hq and Field Units';

format spotyp jobfmt. phase phasefmt. cost costfmt. userloc locfmt.
conusloc dlocfmt. usercmd cmdfmt. oconuser oconfmt. usertyp
userfmt. comfreq comfmt. pho mes meet userint comreq dissat
hqcom uhqcom ucomhq ucomuhq comhq disat dischang ktrchang
savings infocom chanhold urephlp tdyfund resptmt. comtyp
methfmt. deltcost chngfmt. comtyp methfmt. mcomuhq hnnfmt.
mcomfld hnnfmt. numchang numsup supfmt. criteria chanqmt.
asesment poorfmt. proddiv divfmt. rank rankfmt. degree
degrfmt. degtyp typefmt. title titlfmt. exp expfmt. rated
operfmt. decinput decisfmt. formdir userrep urneed sosc sosr
acsc acscr awcc awcr ica other sysone systwo systour sas
dsmc odod ondod. yesnofmt. pme pmefmt. school schfmt. expsum
expfmt. spo spofmt. usrsum hqfldfmt.;

proc freq;
  tables spotyp -- usrsum;
  tables spo*(comfreq pho mes meet comreq udissat disat
    savings infocom comtyp asesment) / chisq
    nocol norow;
  tables pho*(phase comfreq decinput) / chisq nocol norow;
  tables userint*(comfreq pho mes meet udissat) / chisq
    nocol norow;
  tables comtyp*userloc / chisq nocol norow;
  tables numchang*(comfreq comreq disat dischang ktrchang
    formdir) / chisq nocol norow;
  tables amount*oconuser / chisq nocol norow;
  tables userrep*(spo usercmd) / chisq nocol norow;
  tables urneed*(usercmd disat urephlp userrep mcomfld mcomuhq
    / chisq nocol norow;
  tables tdyfund*(conusloc pho urneed) / chisq nocol norow;
  tables asesment*oconuser comfreq pho meet mes urneed userint
    / chisq nocol norow;
  tables rank*comfreq / chisq nocol norow;
  tables comfreq*(degree rated expsum decinput sysone systwo
    systour sas expsum) / chisq nocol norow;
  tables uhqcom*hqcom / chisq nocol norow;
  tables ucomhq*(hqcom uhqcom) / chisq nocol norow;
  tables disat*(comreq udissat infocom spo) / chisq norow nocol;
  tables dischang*(ktrchang sas) / chisq nocol norow;
  tables chanhold*formdir / chisq nocol norow;
  tables mcomuhq*savings / chisq nocol norow;
  tables decinput*formdir / chisq nocol norow;
  tables school*(disat udissat comfreq pho mes meet
    asesment formdir dischang infocom urephlp

```

```
urneed) / chisq nocol norow;  
tables urephlp*(userrep asesment) / chisq nocol norow;  
tables sysone*urneed / chisq nocol norow;  
tables title*proddiv / chisq nocol norow;  
tables numchang*(comfreq userint) / chisq nocol norow;
```

Appendix D: User Representative
Interview Questionnaire

Guided Interview Package

Research Point of Contact: Captain Russ Smariga
AFIT/GSM87S
Wright-Patterson AFB, OH 45433
x56569, x55435

Research Topic: The Communication of System Requirements from
the User to the System Program Office.

Any comments which you wish to add in response to question 15,
or any other question, may be written below and on the reverse.

Thank you for your cooperation.

USING COMMAND SYSTEMS OFFICER GUIDED INTERVIEW FORM

The data gathered in this guided interview will support an AFIT research project dealing with the communication of system requirements from the User to the System Program Office (SPO). Results of the project will be published in an AFIT Thesis.

Please answer each question as candidly and honestly as possible. Any additional information or comments which you think may be helpful may be included on the attached page, or on additional paper.

Participation is completely VOLUNTARY. Results will be published in composite form only. No attempt will be made to identify any individual respondent. All responses will be taken ANONYMOUSLY.

Thank you for your cooperation!!!

1. Are you involved with the:
 - a. MACSO
 - b. SACSO
 - c. TACSO
 - d. Other (Please Specify) _____
2. What is your current rank? _____
3. How long have you been in your current position?
 - a. < 1yr
 - b. 1 - 2yrs
 - c. 3 - 4yrs
 - d. 5yrs or more
4. In what phase is (are) the program(s) with which you work?
 - a. Concept Exploration
 - b. Demonstration/Validation
 - c. Full Scale Development
 - d. Production/Deployment
 - e. Post-Production/Modification
5. In what phase was the program when you first assumed your current position?
 - a. Concept Exploration
 - b. Dem/Val
 - c. FSD
 - d. Prod/Dep
 - e. Post-Prod/Mod

6. How often do you meet with personnel from the using command which you represent to discuss program requirements?
- a. Never
 - b. < Once a month
 - c. 1 - 2 times/month
 - d. 3 - 5 times/month
 - e. > 5 times/month
7. When you meet with personnel from the command which you represent are they most often from:
- a. Headquarters/Staff level
 - b. Numbered Air Force level
 - c. Wing level
 - d. Squadron/Unit level
8. Was your previous assignment related to the mission area of the program(s) with which you are currently involved?
- a. Yes
 - b. No

If yes, in what way? _____

9. Have you worked in any acquisition related position prior to this assignment?
- a. Yes, as a _____
with an AFSC of ____.
 - b. No
10. Check each of the following acquisition courses which you have had.
- a. AFIT Systems 100
 - b. AFIT Systems 200
 - c. AFIT Systems 400
 - d. Systems Acquisition School at Brooks AFB
 - e. Defense Systems Management College
 - f. Other Courses _____
-
- g. None
11. Do you feel that more operational experience on the part of the Program Managers in the SPO would enhance communication of requirements from the User to the SPO?
- a. Yes
 - b. No
12. Do you feel that more acquisition training on the part of the User would enhance communication of requirements from the User to the SPO?
- a. Yes
 - b. No

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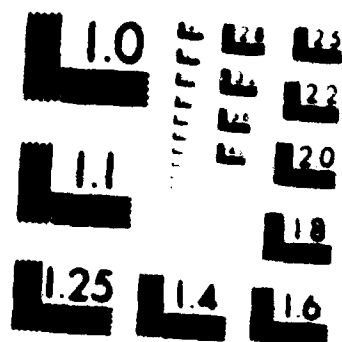
THE COMMUNICATION OF THE USER'S REQUIREMENTS TO THE
SYSTEM PROGRAM OFFICE. (U) AIR FORCE INST OF TECH
WRIGHT-PATTERSON AFB OH SCHOOL OF SYST.. R B SMARIGA
SEP 87 AFIT/OSM/LSV/87S-31 F/G 23/5

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13. Do you feel that more acquisition experience on the part of the User would enhance communication of requirements from the User to the SPO?
- a. Yes
 - b. No
14. What do you feel is the biggest problem (if there is one) with the communication of requirements from User to SPO?
- a. Schedule pressure
 - b. Lack of operational experience on the part of the Program/Project managers
 - c. Overall lack of experience of Program/Project managers
 - d. Lack of acquisition experience on the part of the Users
 - e. Other _____
15. Other comments:

Appendix E: Selected Comments from
User Representatives

The user needs the system immediately and perceives the acquisition process as too slow and unresponsive. In several cases the needed system is not fielded for 5-7 years and occasionally not even in the same decade. In the ECM field against our primary adversary this guarantees acquisition of antiquated resources to counter historically obsolete threats. In this light I believe the primary cause of poor communications between the user and SPO is the result of both organizations striving to accomplish their missions utilizing an over regulated, highly restrictive, bureaucratic structure that stifles initiative and retards acceptable progress.

Only takes a short (month or two) period of time for operationally experienced users to learn how the acquisition process works.

Eliminate ASD and let the User acquire his own weapon systems.

More acquisition training on the part of the user would aid in communications, but probably not enough to make a difference.

More acquisition experience on the part of the user would aid in communication, but you can't be everything in a career and still progress.

With manning levels critical in operations, its hard to [get more acquisition experience and training].

[The biggest problem with the requirements communications process is the] misunderstanding, perhaps from lack of experience of users on how acquisition system works.

I never meet face to face with people from HQ TAC (or very rarely, i.e. once a year). However, we do speak on the phone anywhere from 1 to 10 times a month, depending on the program. I deal with people at the Headquarters/Staff level.

I appear to be an odd case, since TACSO is my first assignment: I have no operational experience to offer the acquisition community. All I do is act as an intelligent messenger for HQ TAC.

In my opinion, the ability to write, speak, read, and think clearly and logically are the first things necessary to communicate requirements. That may seem obvious, but it is lacking in the acquisition community particularly.

Better communication may help the user and acquisitioneer understand each other better and get along better, but I doubt it will improve the acquisition process as a whole. At best it will make our jobs easier, because we wouldn't have to shout so loud to make the acquisitioneers understand why we need the system now, and he wouldn't have to shout so loud to make us understand that the contractor is not producing as expected, as is typically the case.

Training would not help the requirements process, but would help HQ users work more harmoniously with the SPO by understanding the acquisition process, problems, frustrations, etc.

[SPO's need to] understand that requirements do change and flexibility in acquisition is required. Avoid accusations of "gold plating." If requirements are overstated, work with the user to resolve.

The biggest problem with the communication of requirements is lack of user discipline!

I could use more operational experience!

Until they have been working in the acquisition arena for an extended period, users (flyers) have an extremely difficult time with simply understanding acquisition jargon (acronyms, technical terms, etc.).

[User] Requirements: - Faster Horses
 - Stronger Whiskey
 - Younger Women

SPO Interpretation: - Speed up the Merry-Go-Round
 - Get a 'Shirley Temple' Double
 - Recruit Pre-School Ballerinas

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VITA

Captain Russell B. Smariga was born on 14 March 1960 in Pasadena, Texas. He graduated from high school in Deer Park, Texas, in 1978 and attended Baylor University in Waco, Texas. In May 1982 he received the degree of Bachelor of Arts in Chemistry. Upon graduation, he received a commission in the USAF through the Reserve Officer Training Corps. He was employed as the manager of the roof truss construction department of Nash Robinson Company, Waco, Texas, until called to active duty in October 1982. He then served as the Chief, TR-1 Ground Station Exploitation section for the Reconnaissance Programs Directorate, Deputy for Reconnaissance/Strike and Electronic Warfare, Aeronautical Systems Division at Wright-Patterson AFB, Ohio. In May 1986 he entered the School of Systems and Logistics, Air Force Institute of Technology.

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Block 19. Abstract.

Air Force acquisition program management officers were surveyed to determine which factors in the user to system program office requirements communication process were related to achieving effective communication. Using command representatives working at Aeronautical Systems Division were also contacted to provide their perspective of the communications process. Results obtained from reading the comments on the questionnaires and from the interviews indicated that both program managers and user representatives believed that additional operational experience on the part of acquisition management personnel would enhance the requirements communication process. The analysis of the data, however, did not support this. Operational experience of the program manager was not statistically related to any of the measures of successful communications.

Program managers who had completed AFIT Systems 100 tended to have a more positive outlook on both the desirability of having a user representative in the SPO, and of the overall requirements communication process. This relationship was not present for any other single acquisition management-related course.

The results indicate that no single factor contributes significantly to the success or failure of the systems requirements communication process.

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